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DELAWARE AND HUDSON CANAL COMPANY.

We have before us the reports of this company for the 1st March, 1840 and 1841, which we will endeavor to elucidate, particularly as its safety as an investment, and the security of its debt to the State of New York, have of late been much discussed, with considerable variance of opinion in regard thereto. It certainly has been made to present the anomaly of late, of being at a premium, while New York State stock, certainly as secure as the rock of Gibraltar, is at a considerable discount. The stock of this company having been hitherto viewed as so entirely speculative, it is but natural at this period of general distrust, to enquire if any thing has occurred to take from it that character.

Its property consists in coal lands, railroad, canal, and sundry apparatus, the whole of which is said to have cost up to this time, three millions of dollars, of which there is said to be of their own capital, 2,000,000 at 7 per cent interest is $140,000

Borrowed money from the State of New York, due in 1848,		$500,000	
Due in 1850,		300,000	
		800,000	
Private loans,		200,000	
			1,000,000
On which the annual interest is			55,500
			$195,500

being the amount they must nett from their *coal speculation*, to get an ordinary return on their capital, added to the risk of which, is the ownership of a canal, and other means of getting their coal to market.

Passing over their early struggles, we will start from the last three years, when they commenced to do a business somewhat commensurate to their establishment, and in that period it has been gradually increasing: thus,

In 1839, their shipments of coal were	-	-	122,300	tons.
In 1840,	do	do	do	-	-	148,500	"
In 1841,	do	do	do	-	-	190,000	"

In the two first years, their dividends were 7 per cent. per annum; and for the first half of the past year of 1841, they have announced one of 5 per cent., or 10 per cent. per annum.

What then is the evidence that these dividends have been really earned? The preliminary step to come at this, is to find what may be near the *first cost* of their coal placed in market. This must necessarily be of a sliding nature, owing to much of their establishment being a fixed expense—such as five stationary steam engines, cars, steamboats, office rent and salaries. As an average, however, the following statement will come as near to the truth as is practicable, where the actual wear and tear of successive years, is not strictly assessed on each, but is often heaped on the last.

Mining, transportation, repairs, over 16 miles of railway, with five stationary engines, say, per ton, - -	$1 50
Freight in 30 ton boats, 105 miles of canal, of 110 locks,	1 40
Toll to meet canal repairs and expenses, say $100,000 per annum; on a business of 190,000 tons, - - -	53
General charges, office rent, salaries, steamboats and barges between New York and Rondout, etc., on 190,000 tons,	27
Interest on loans $55,500 per annum on a business of 190,000 tons, - - - - - - - -	30
Say average cost delivered at Rondout or New York, on present large trade, per ton, - - - - -	$4 00

There is no charge made above for mine rent of the coal dug from, and by which their mines are annually so much depreciated—worth at least 25 cents per ton—no allowance for bad debts, nor for waste, nor sinking fund, as in strictness there should be, but against the two first, there is the set off of the return freights and a surplus of interest averaging together say, $45,000, and the waste, etc., may be covered by their selling at the short ton of 2,000 lbs.

Taking their own statement of the 1st March, 1841, and starting

with the balance then assumed to be in hand, we may come at some understanding of the result of their operations in the last three years, and which appears to be, that a combination of luck in this last, has enabled them not only to make good all their previous dividends, but also to have the appearance of being left with a large surplus: thus,

By balance on hand 1st March, 1841, including coal on hand, the whole assumed by their statement to be worth at that date - - - - - -	$211,233
By sales of all their coal for 1841, 190,000 tons, at an average of $6¼ per ton, at Rondout and New York	1,187,500
By canal tolls and interest, say - - - - -	43,267
	$1,442,000
To dividends of 1839 and 1840, 7 per cent. each, or 14 per cent. on $2,000,000 - - - - -	$280,000
To cost of placing 190,000 tons of coal at Rondout and New York, including interest on loans, at an average of $4 per ton - - - - - -	760,000
To dividend of 1841 at 10 per cent.* - - -	200,000
To surplus, *supposing all their coal realized by the 1st of March*, 1842 - - - - - - -	202,000
	$1,442,000

The present year has been one of real harvest to this company. The foreign supply of coal has fallen off nearly one half, and but little of the old stock of anthracite remained at the opening of the season—while it was then enabled to begin operations without having received any material injury from the freshet of the 8th of January, 1841, which disabled its rivals, the Schuylkill for 2 months and the Lehigh canal for 5 months of the usual shipping season of 8 months; prices, therefore, although fluctuating during the year, have ruled higher than the last, and the average allowed to this company

* Then comes the question as to what is, at any given time, really left to divide as actual profit, the current expenses being understood to include the whole expenditure in every shape, and not merely the expenses paid, and which alone it was possible to have paid, but there should be ample security, that what appears in the account as nett profit, really is such, and that the future proprietors are not left responsible for any portion of the expenditure which has in fact been incurred and exhausted in earning the present apparent dividend. The object should be to avoid heaping an unusually larger expenditure on particular periods for wear and tear, which has been going on gradually during a whole series of years. A per centage as sinking fund should be set aside for this purpose, the amount of which will vary on different lines, according to the degree of excellence in the original construction of the work and stock, and to the *efficiency of the servants and establishments* of each company.—*English Railway Magazine.*

in the above account, for their sales between New York and Rondout, is a full one. The present rate of Peach Orchard is $9, for Lehigh $8¼, for Schuylkill white ash, $8, and Lackawanna $7 per ton—all in retail from the yards, or ¾ to $1 per ton less if sold afloat; and this latter coal—not generally so well liked as the other white ash coals—sells freely, however, at a dollar under them. It is said to be a great favorite with steamboats and the distillers, and has perhaps an advantage in being delivered more directly in market from the mines, without being subject to as many intermediate profits and charges which increases the cost of much of that from the Schuylkill and Lehigh regions.

To all outward appearance this company is managed with great economy in all its details, and were the present state of things to remain undisturbed,—that is, were it never to be possible to get anthracite coal to market other than by canals, then this coal speculation of the Delaware and Hudson canal company would seem sure to pay a fair return, and with the natural increase in the trade, might become very profitable.

What then can be said on the other hand, that is likely to subtract from so fair a prospect. It may be supposed that we all do, or should know, that the Philadelphia and Pottsville railway will be completed in a very few days, and although it may be difficult of belief to those interested in canals, it has really come to pass in the progress of the arts, that railways, as now constructed, can generally carry cheaper than canals, but particularly so in this case, as may be thus familiarly illustrated:

On the *Schuylkill canal*, 6 boats each of 54 tons, can deliver, on an average, in 10 days, 324 tons of coal in all, at a cost to each boat of $45, (except a charge for renewal of boat,) or together $270, being, as freight, per ton, - - - 83 cents.

On the *Pottsville railway*, 1 locomotive and train of 50 cars can make five trips in 10 days, and deliver 200 tons each trip, or 1,000 tons in all, at an expense of $85 per trip, or $425 together, being per ton, - - - - 42½ cents.

The cost of freight on the canal, is, therefore, double that on the railway, and together with other economies possessed by the latter, it is enabled to advertise that it will deliver coal in market at $1¼ for the winter, $1¾ for the spring, and $2 per ton for the summer. Experience on other roads also teaches us that if these rates do not bring the trade, lower rates will be submitted to, the certain effect of which will be to force down the high toll and freights hitherto maintained on the other canals, and which have only operated as a bounty on the coal by the Delaware and Hudson. The Lehigh also hopes in the coming season to obtain an outlet at Blacks Eddy into the feeder of the

Delaware and Raritan canal, which will help to reduce its present cost of transportation—it may therefore be expected that the competition of the railway, as a cheaper carrier in the coal trade, will create the liveliest competition in it, and that prices will be brought down to the very lowest, at which they can be afforded, say $4\frac{1}{2}$ to $5 per ton afloat; so that if the Lackawanna is to sell at 75c. to $1 per ton, as heretofore, under those rates, it is evident their speculation will be rendered very hazardous, neither can any thing be gained by curtailing it—the per ton cost, would only be increased thereby—onward is their only alternative, as it must also be with the other regions. It is, however, perceptible enough, that if they can maintain their business at 200,000 tons per annum, (and some are sanguine enough to think it practicable, by the increased consumption from low prices and spite the numerous avenues) that at $4\frac{1}{2}$ per ton, they can divide 5 per cent. per annum on their capital of $2,000,000, and at $3 80 to $4 per ton the loan holders would be secure of their interest. We shall indeed be agreeably surprised ever to see it below this last price, and the public should be satisfied to get their fuel at even $4\frac{1}{2}$ to $5 per ton, but that it should be cut down from 7 and $9 per ton, was in all humanity called for; and as the *only means* of attaining this truly charitable result, must they return thanks to the railway.

Although at present, rather a remote contingency, yet it is not altogether to be overlooked in scanning the future prospects of this company, in how much the Erie railway, which is to be located on the line of the Delaware and Hudson canal, will take from its back freights, and also what competition may come from the owners of the other coal lands in the Lackawanna region, who have proposed to connect with the Erie railway at a convenient point, which, via the Paterson railroad, would bring *their mines* within 140 miles of Jersey City, while those of the Delaware and Hudson, by railroad canal, and river, are 211 miles from New York. But this advantage in distance by the Erie railway route, is counteracted in part by its very high grades, and it will do well if it transports the coal as cheaply as by the canal route. Its main advantage will be in winter, and as being another scource of supply in emergencies.

We have thus endeavored to present impartially, whatever could be said for or against this concern, and we are free to confess it stands on firmer ground, than we, at one time, believed, which, as favoring the desirable object of cheapening fuel, while all interests are fairly served, is a pleasing persuasion to arrive at.

It would not fail to add to the confidence in this concern, could it find it to its interest to make its annual statements somewhat more businesslike and explicit.

And now for some of the latest statistics in the coal trade.

The consumption of anthracite coal in the last three years, has been in the following ratio:

1838 - - - - - - - - -	788,000 tons.
1839 - - - - - - - - -	867,000 "
1840 - - - - - - - - -	965,000 "

which includes the demand at tide water, as well as that on the line of the several canals, equal, in all, therefore, to 80,000 tons per month.

In the present year of 1841, there have reached *tide water* from the Schulkill region, per Philadelphia commercial list - - - - -	557,000 tons.	
Lehigh (total shipped 142,000 tons) reached tide water - - -	110,000 "	
Lackawanna (said to have reached Rondout) - - - - - -	190,000 "	
		857,000 tons.
Quantity left over 1st June, 1841, at which date supplies began to reach market - - - - - - - -		50,000 "
		907,000 "
Subject to 10 months consumption, *on tide water*, between 1st of June, 1841, and 1st of April, 1842, at, say 75,000 tons per month - - - - - -		750,000 "
Probable stock unconsumed 1st of April, 1842, if not absorbed by increased consumption - - - - - - - -		157,000

Thus may we at least be assured of an abundant supply until the opening of the ensuing season, about the middle of March next, when it were better not to be caught with much of the old stock on hand. The railway from the Schuylkill region will not probably be able to do much before that period, but, mean time, its effect is salutary in checking any further rise in price during the current winter.

The letter from Mr. Williams giving an account of the operations upon the Ohio railroad, will be found highly interesting. We should not omit to mention in this place, that the efficient action and arrangement of the machinery is due entirely to the ingenuity of Mr. Williams himself.

[To the Editors of the American Railroad Journal and Mechanics' Magazine.]

OHIO RAILROAD OFFICE, CLEVELAND, *December* 13, 1841.

You expressed a desire to be informed of our doings on the Ohio

railroad, at as early a day as conveinent, and as the time has arrived when I have a few leisure moments, I hasten to inform you of the progress of our work. The two first divisions between the Maumee river and Lower Sandusky, thirty miles, is now completed ready for the iron. The third and fourth divisions between Lower Sandusky and Huron, thirty-three and one-fourth miles, will also be completed for the iron in March next. The fifth and sixth divisions, between Huron and Cleveland, forty-seven and one-half miles, is now under contract for the clearing and grubbing, and delivery of materials for the superstructure, to be completed in the spring. The company have now four steam piling machines and four locomotive portable saw mills at work, capable of completing five miles of road per month. The above is a summary statement of our work. I will also give you a brief outline of the railroads now in progress in our State, their connection with each other, and their contemplated connection with the roads in other States. First, we look to the New York and Erie railroad with much interest, and contemplate a connection (through Pennsylvania, forty miles) with our road, thereby giving us a direct communication with the city of New York, much nearer than by any other route, being less than five hundred and sixty miles from this city. The Little Miami railroad from the city of Cincinnati, and with the Mad river and Lake Erie railroad, connects with Lake Erie and with the Ohio railroad at Sundusky city, which with the Ohio railroad for a direct line from Cincinnati to the junction of our road, with Pennsylvania. The Mad river and Lake Erie company have their road completed to Tiffin, Seneca county, thirty-eight miles, and in operation with three locomotives. The Little Miami company have also some fifteen miles in operation and one locomotive. The Ohio railroad connects with the Maumee river, opposite Manhattan, at which point the Maumee branch railroad commences, and is to extend to Monroe, Michigan, eighteen miles, which is to be completed in 1842, and at Monroe it connects with the southern road of Michigan, thirty miles of which is completed, more in progress, and intended to extend to the head of Lake Michigan. Thus you will see that we are awake in the idea of a continued line of railroad from one end of the Union to the other, and when the link from the termination of the New York and Erie road to Buffalo, forty-five miles, shall be filled up, we shall be, as it were, near neighbors with Boston and New York. And I can but anticipate that all the roads here ennumerated will be in operation before the close of 1845.

Respectfully yours,

C. Williams.

[For the American Railroad Journal and Mechanics' Magazine.]

PENNSYLVANIA FINANCES.

We have been attracted by the following report, in anticipation, from the Treasurer of the State of Pensylvania, for the fiscal year, ending 30th of November, 1841, and which we have somewhat remodelled, that its principal points may be more clearly seen and understood.

Receipts.			Payments.		
Balance.			*Public works.*		
From last year, 30th of November, 1840	$625,200		Paid for interest and other purposes thereon, total of	$2,844,000	
Debt due on Huntingdon breach and for uncurrent funds	350,500		Deduct for interest on public debt $1,600,000		
		$274,700	Applied towards finishing incomplete works 800,000		
Public works.				2,400,000	
Received from canals	498,600		Leaving for repairs proper and salaries, etc.	444,000	
Received from railways	556,800		Motive power on railways	292,000	
		1,055,400	Repairs extra to Delaware division	68,000	
Taxes.			Loss by fire from locomotives	7,800	
On bank dividends	96,000		Westchester railway	5,000	
Corporation stocks	37,300				816,800
Writs and certain offices	35,000		*Interest account.*		
Collateral inheritance	20,600		On debt for public works	1,600,000	
Personal and real estate per act of 11th of June, 1840	33,300		On debt other than public works	64,000	
	222,200				1,664,000

Auction and commission duties.		
Received on this account - -	89,600	
Licences.		
Taverns, retailers, hawkers and brokers - - - -	126,000	
Fees.		
Land and land offices - - -	24,000	
Dividends.		
From bank, turnpike, mining and bridge company's stocks -	148,400	
Petty receipts - - - - - -	4,500	
		614,700
Loans.		
Various loans of 1840, '41, -	3,704,900	
Deduct paid off in 1841 -	674,900	
		3,030,000
Balance taken from receipts between 30th of November, 1841, and 1st February, 1842		145,600
		$5,120,400

Unfinished lines—expended thereon		800,000
Government expenses paid on this amount - - - -	306,000	
Militia expenses - - -	33,000	
Pensions and gratuities - -	49,400	
Colleges and common schools -	345,300	
Penitentiaries and institutions for the blind - - - -	49,400	
Geological survey - - -	12,700	
Premium on silk - - -	4,400	
Navigation, bridges and turnpike companies - - -	115,200	
Petty charges - - -	24,200	
		939,600
Interest account.		
Half yearly interest, due 1st of February, 1842, in specie funds - - -		900,000
		$5,120,400

Before remarking on the above statement, we may premise, that it has been the misfortune of Pennsylvania, that she has allowed her authorities to present their accounts studiously involved and obscure, and if this system of permitted concealment be allowed to continue, her present heavy load of debt can only grow the heavier. The detailed minutia furnished by the canal board of the State of New York, and the periodical investigations instituted by her legislature, through a select committee, into the actual condition of the public works, might well be recommended to her imitation.

So far as the above statement is to be relied upon as a guide, it presents the following features:

The receipts on her public works in 1841, were	1,055,400	
The disbursements for maintainance and repairs, etc. - - - - - - - - -	816,800	
		238,000

showing a surplus, but which it is quite probable outstanding and unsettled claims, would nearly absorb, and it will be well if we can feel assured, that the two ends now really meet.

The government expenses and other incidental payments, amount to - - - - - - - -	939,600
The receipts from taxes and all other ordinary sources	614,700
Showing a deficiency on ordinary account of -	$324,900

This deficiency together with the interest on her debt up to the 1st February, 1842, will all have been met *principally by loans*, which also in that period, admitted of the appropriation of about $800,000, to her unfinished lines, such as the Wisconissco feeder, the north branch canal, etc.

The amount required to be raised before the 1st of February, 1843, in order to maintain her credit would then appear to be:

Interest due on public debt, a serious reality of, say	1,700,000
Deficiency on ordinary account and for contingencies, say - - - - - - - - - - -	500,000
	$2,200,000

and not allowing any appropriation to carry out unfinished lines, some of which, it is, however, of vital importance to complete, as now only making a total loss of the sums already expended on them.

In the present crisis of State credit, this sum can no longer be borrowed, at least out of her own borders, and can only otherwise come from the public works and taxation.

Of her public works, we can only say, that owing to the blended manner in which the accounts are given to the public, it has an impression, and seemingly a just one, that they are minus of themselves some $500,000 per annum, which, however, is belied by the above account, if it can be depended upon. There is undoubtedly something radically wrong in the management of these works—the *higher costs* of transportation by them for a shorter distance by one half, and the inefficient *state of the main stem* terminating at Cleveland, during the past season, caused much of the western trade to be diverted to the New York works, as their increase of tolls too well attest. Cannot *all this* be remedied for the future? Will it be in vain, now that this crisis has arrived in the affairs of this great State, that she has elected to her legislature a large *democratic majority*, whose business will be to see *the needful* carried out. The time has arrived when truth must be stared full in the face.

Of taxation:—the above account shows only the insignificant item from real and personal estate of $33,300, under the act of 11th of June, 1840, but it will be remembered that at the session of 1841, the acts regulating assessments on real estate were remodelled, by which the receipts were to be largely increased and other taxes were also laid, the effects of which have not yet appeared. The Harrisburg Intelligencer some time since furnished an able estimate of all the real estate, mineral and agricultural products of Pennsylvania, and which were made to amount to $1,460,000,000, presenting an abundant source, from which to derive all that was necessary. Could the Intelligencer point out a way by which this might be done, and help in some measure to allay the present anxiety, and to do away with the foolish notion that her public works, by which her other valuable means can only be properly developed, are to be given away, before it is seen that they cannot be made to work satisfactorily?

A writer in the United States Gazette of Philadelphia, anxious for the proper management of the Pennsylvania works, makes the remark, that "the cost of freight from Philadelphia to Pittsburgh will average the season round 100 per cent. more than from New York to Buffalo, besides being subject to two or more transhipments," and suggests as a remedy to this diversion of so much of the trade to the New York works,

1st. To reduce the tolls 33 per cent.

2d. To open the communication from Pittsburgh to the Ohio river, and there to unload from canal boats into the steamboats.

3d. Establish the lowest remunerating rates of freight, to be permanent throughout the season, and not slide from $2 50 early, down to $1 50 per 100 lbs. later in the season.

4th. Continue in one line from Philadelphia to Portsmouth, by way of Akron, on the Ohio canal, that *one receipt* may answer for the whole line, which would bring largely the produce of eastern Ohio, nearly all of which now goes to New York.

The present crisis admits of no more procrastination; on the dose to be now prescribed hangs the life or death of these only debilitated works; if of the right kind and *honestly* administered, recovery may, we think, be confidently hoped for. Let her best practitioners be summoned to the rescue. *The consequences to her creditors are too plain, if these assets are allowed to perish.*

State credit now presents the sorry spectacle of a battered ruin, of which, however, if Pennsylvania the keystone, gives way, not a vestige will be left. Such then is the responsibility which rests on her coming legislature.

[From the Journal of the Franklin Institute.]

PROGRESS OF PRACTICAL AND THEORETICAL MECHANICS AND CHEMISTRY.

Upon the Application and Use of Auxiliary Steam Power, for the purpose of shortening the time occupied by sailing ships upon distant voyages. By SAMUEL SEAWARD, *Member Inst. C. E.*

But few years have elapsed since the possibility of propelling vessels by the power of steam was treated as a chimera; and although the practicability of its application for short voyages has been successly demonstrated, by the numerous vessels plying between this country and the continent, it is but of very recent date that its employment for long sea voyages has been adopted. The weight of the powerful machinery and the fuel, and the consequent loss of space for cargo, together with many other circumstances attendant on the present construction of steam vessels, induced the author (who received the education of a seaman, and has since had extensive practice as an angineer,) to believe that a more efficient mode of employing steam power, for long sea voyages, might be adopted.

Notwithstanding the great improvements which have taken place in the construction of steam vessels, and their machinery, it would appear that the duration of the voyage ought not to exceed twenty days, after which time a fresh supply of fuel becomes necessary; hence, steam has rarely been adopted for very long voyages. The reason of this limit to the duration of the voyage of a steam vessel, as at present equipped, is that an increase of power does not produce a corresponding increase of speed, while the weight of machinery increases in proportion to the power employed, and in some cases exceeds it; for instance, small engines, with the water in the boilers generally weigh about one ton per horse power, while in some large engines the ratio is nearly twenty-five cwt. per horse power.

A quadruple increase of power will not produce double the original velocity in a steam ship, although in theory, such is assumed

to be the case; for, as the weight is more than double, the immersed sectional area becomes greater, and a still further increase of power is necessary. It has been shown by experience, that if a vessel, with a given power, is propelled through the water at the rate of eight miles per hour, her speed cannot be doubled, even though the power be multiplied twelve times, and the entire hold of the vessel be occupied as an engine room.

The weight of fuel is also in direct proportion to the size of the engines; so that taking for example, two vessels of two hundred and of four hundred horse power respectively—that of the higher power will have to carry nearly double the weight, both of fuel and of engines, and it is still questionable whether the increased force will propel the one ship more than one and a half miles per hour faster than the other.

The space occupied by the engines and fuel, in the most valuable part of the ship, is also an important consideration: neither the "President" nor "British Queen" steamers, although of two thousand tons measurement, is capable of carrying more than five hundred tons of cargo, when the fuel is on board.

The author then examines the question of employing too much power in a steam vessel, and refers to the "Liverpool," as an instance that such may be the fact. It appears that with the original dimensions of thirty feet ten inches beam, and engine power of four hundred and fifty horses, being a proportion of power to tonnage of about one to two, and one-fourth the vessel was immersed four feet beyond the calculated water line, and a decided failure was the natural consequence; but when the breadth of beam was increased to thirty-seven feet, augmenting the capacity of four hundred tons, and giving the proportion of one horse power to three and three-fourths tons burthen, the performance of the engine and the speed of the vessel were both materially improved.

The "Gem," Gravesend steamer, one hundred and forty-five feet long, by nineteen feet beam, had two engines of fifty horse power each; the speed was insufficient, being only twelve and a half miles through the water; but when the same engines were placed in the "Ruby," which was one hundred and fifty feet long, and nineteen feet nine inches beam, the velocity of the latter vessel was thirteen and half miles per hour. A pair of engines, of forty-five horse power each, were then placed in the "Gem," without altering the vessel, and in consequence of the diminished weight and draught of water, her speed then nearly equalled that of the "Ruby."

The author does not condemn the application of considerable power for vessels, providing it can be employed without materially increasing the weight and the area of the immersed midship section. It appears that the length of a steam voyage, to be profitable, is at present limited to twenty days for the largest class of steamers; that we have about thirty others which can approach twelve days, while the majority cannot employ steam beyond eight days successively, without a fresh supply of fuel. It is evident, therefore, that more efficient means must be adopted for the general wants of commerce in our extended intercourse with the East and West Indies, the

Pacific, Mexico, Brazil, Australia, and all the distant colonies, which now demand rapid communication with England.

The author refers to a pamphlet, published by him in 1827, entitled "Observations on the possibility of successfully employing steam power in navigating ships between this country and the East Indies, by the Cape of Good Hope." He therein proposed that large square rigged ships, of fifteen hundred to eighteen hundred tons measurement, should be fully equipped and constructed so as to sail ten or eleven miles per hour with a fair wind; that they should carry engines of small power, to assist the sails in light winds,—propel them at a moderate speed during calms,—work into and out of harbor, etc.,—and thus shorten those portions of the voyages wherein so much time was usually lost.

To all well built good sailing vessels, of four hundred tons and upwards, "auxiliary steam" is applicable. A steam engine of the necessary power, can, without inconvenience, be placed in such vessels, either on or between decks, so as to propel a ship at the rate of four to five nautical miles per hour in a calm, and for this speed a proportion of one horse power to twenty five tons is amply sufficient. The practicability of applying this system to East Indiamen and other similar vessels, is then examined at length, and it is shown that the ordinary speed of these ships under sail, is before the wind, eleven to twelve miles per hour, and in a gale thirteen to fourteen miles per hour, which is greater by two or three miles per hour, than that of any ordinary steam vessel when under sail, on account of the latter being impeded by the wheels trailing in the water, and the slightness of their masts, spars and rigging. The auxiliary steam power might, therefore, be efficiently applied, either by using it alone, or in conjunction with the sails, so as to keep up a uniform speed, by which a great saving of time could be effected in a long voyage.

The conditions of sailing and steaming voyages to India, with the influence of the trade winds, are then examined, and the author proceeds to detail the experiments made by him, on board the "Vernon" Indiaman, which was the first sailing vessel that actually made a voyage out and home with "auxiliary steam."

The "Vernon," built in 1839, by the owner, Mr. Green, was one thousand tons burthen; the sailing speed was about twelve to thirteen miles per hour in a fresh gale, and being from her frigate build well calculated for the experiment, it was determined to equip her with a condensing engine of thirty horse power, placed midships on the main deck, between the fore and main hatchways; the space occupied being twenty-four feet long by ten wide. The weight of the machinery was twenty-five tons, and it was so arranged that the motion was communicated direct from the piston cross-head, by two side rods, to the crank on the paddle shaft, placed immediately behind the lower end of the steam cylinder, which was horizontal. The wheels were fourteen feet diameter, projecting five feet, and were so constructed that the float boards could be raised to suit the draught of water of the ship; or they could be taken entirely away, if necessary, leaving the shafts projecting only eighteen inches be-

yond the sides. Under ordinary circumstances they were disconnected from the engine by a simple contrivance, consisting of a movable head, attached to the crank on the paddle shaft. by turning which, one quarter of a circle, the crank pin was liberated, and the wheels turned freely round. The "Vernon," thus equipped, having on board nine hundred tons of cargo, and sixty tons of coal, drew seventeen feet of water. In the first trial, the speed of the vessel, under steam alone, was five and three quarters nautical miles per hour, demonstrating how small a power is necessary for a moderate speed. She then started for Calcutta, and though the piston rod broke three times during the voyage, owing to a defect in one of the paddle shaft bearings, the passage was satisfactory. The details are given minutely, as are also those of the homeward voyage which was performed from Calcutta to London in eighty-eight days, to which must be added seven days for necessary delay at the Cape, making a total of ninety-five days, which is the shortest passage on record. Great credit is given to Captain Denny for the judgment with which he used the auxiliary steam power, and the course taken by him, by which he was enabled to overcome the difficulties incidental to a first trial of so important a system. The success of the "Vernon," induced the immediate application of engine power to the "Earl Hardwick" Indiaman, and both these vessels are now on their voyage out to Calcutta.

For the purpose of demonstrating the ratio of power to velocity a table was also given, showing the velocities of ships of different tonnage, having steam power of various ratios, deduced from upwards of one hundred experiments on large steam vessels.

It was shown, that an engine of thirty horse power would propel a ship of twelve hundred tons burthen, at the rate of four knots per hour, while three hundred horse power would only propel the same ship at the rate of ten and five-ninths knots per hour. Hence, ten times the power would only prodnce about two and a half times the speed.

The principal points in the paper were more fully dwelt upon, and, in answer to questions from some of the members, Mr. Seaward remarked, that no steamer in England had ever been propelled at more than fifteen geographical miles per hour, through still water.

In some of the Government mail packets, the engines and coals were the full cargo of the vessel. The table did not apply to vessels overladen with power, for as the weight increased in the same ratio of the power, so the immersed sectional area was augmented, and the lines of the vessel, which might be well calculated for speed when at a proper draught, became lines of retardation, and the engines did not work up to their proper speed, owing to the depth to which the paddle floats were immersed. For instance:—The wheels of the "British Queen" have been plunged between six and seven feet, instead of four feet, which was the calculated dip; the engines at the same time diminishing their speed so much as to reduce the effective power from five hundred horses to nearly three hundred horses.

The only advantageous way in which great power could be applied, would be by contriving to prevent the increase in the weight of the machinery and fuel, and those engineers would be most successful who could so apply the materials of construction, as to ensure strength without the usual corresponding increase of weight.

Mr. George Mills, from his experience as a ship builder, at Glasgow, was enabled to confirm all that Mr. Seaward had advanced. On the Clyde, the employment of an excess of power in steam vessels had been carried to the greatest extent, without producing corresponding advantages either for speed, or in a commercial point of view. It would appear that the same error had, to a certain degree, been committed on the Thames, but less than on the Clyde; for on the latter river there were vessels with nearly double the power, in proportion to the size, as compared with any vessel on the former river. He believed that on the Thames no vessel had so much as one horse power for each register ton, whereas on the Clyde, there were steamers of seventy to eighty tons register, having single engines, with cylinders of fifty-four inches diameter which was more than one hundred horse power. It would appear that this application of extra power had only obtained a very moderate speed, while the great first outlay, with the commensurate current expenses, had reduced the commercial profit to the lowest point,—of this the proprietors alone could give any account; but as to the speed attained, he had seen three steamers of identical tonnage leave the Broomielaw at the same time, their engines being respectively of one hundred and ten, eighty, and sixty horse power; yet their speed was in the inverse ratio of their power: the vessel with the smallest engine arrived at Greenock first, the greater power second, and the greatest last. These remarks were only applicable to river boats. With regard to sea-going vessels, the system had not been carried to so serious an extent, yet with them the average proportion was about one horse power to two register tons, and some few reached as high as one horse to one and one-eighth of a ton.

As an example of an augmentation of power producing an opposite result from that which was intended, Mr. Mills mentioned two vessels called the "Tartar" and the "Rover," built by him and his (then) partner, Mr. Charles Wood. They were each of about two hundred and twenty tons register, built from the same draught, and in every respect as similar as possible, except that the engines, which were by the same maker, were respectively of one hundred and seventy and one hundred and thirty horse power; yet whenever they worked together, the one with the smaller power proved herself the faster vessel, either in a calm, with the wind, or even against it. The "Achilles," Liverpool steamer, which lately had an addition of thirty feet to her length, and eighteen inches to her breadth, augmenting the tonnage about one-fifth, had improved her speed upwards of one mile per hour, although she carried a much heavier cargo than before.

He had built a vessel of five hundred and sixty tons register, with engines of one hundred and thirty horse power on board—a proportion of power to tonnage of one to four; the stowage for cargo

was ample; the accommodation for passengers excellent. She drew little water, and her speed was much greater than vessels of double her power. Yet in spite of all this, the vessel could not find a purchaser, because the power was not nominally large.

It would be asked—why, with these and so many similar instances, such a system was continued? It was not likely that the engineers would complain of having orders for large engines: and there were certain dimensions prescribed for the vessel, to which the ship-builder was under the necessity of conforming.

The chief cause of mischief, however, was the fiat of the public. It was believed that a great power would remedy want of speed and all other evils, and it was found indispensable for ensuring the confidence of travellers. Hence, the shipowners, who depend upon the public for support, were obliged, against the conviction of their experience, to keep up the errors occasioned by ignorance.

The president observed, that the condemnation of large power should not be carried too far, as experience alone had produced the increase of weight, strength and power, of the present engines, compared with those of the early steamers which were built, instancing the Halifax packets (Cunard's,) which with their great power in proportion to tonnage, had performed their duties satisfactorily.

Mr. Mills explained that the Halifax packets were built for the especial purpose of carrying the mails only, to perform the voyage in a given time,—about twelve days. The engines were built by Mr. Robert Napier, after the model of those of the "Great Western," which used their steam expansively; similar provisions had been made in the Halifax packets, but the expansion valves were seldom used.

Mr Field agreed with the principal part of Mr. Seaward's paper, but he would prevent an erroneous conception of the term *overpowering* a steamer. A vessel could not have too much power, provided that power could be advantageously applied, without causing too deep an immersion. A good result could be produced only by keeping a proper proportion between the machinery, the vessel, and the paddle wheels, and immersing the hull of the steamer only as deep as the true lines of draught.

Mr. Vignoles observed, that in this country the reputation of engineers depended upon the commercial success of the works they engaged in. An erroneous public opinion might have influence at present; but if the engineer and ship builder would determine to break these trammels, and produce such vessels as should force conviction upon the public mind by the speed attained, and show the proprietors the consequent commercial advantage, the present system would soon be abandoned.

Mr. Parkes eulogized Mr. Seawards candor in describing the errors in the first construction of the engine on board the Vernon; more was frequently to be learned from failures than from successful efforts, and no communications to the Institution would be so useful as those which gave accounts of defective design or construction, with the details of the methods adopted for remedying the defects. He directed attention to the performances of the "Great Western" steamship, which at least equalled those of the Halifax packets, without the disadvantages of being unable to carry cargo, or of shipping so much sea, when the weather was foul. The important feature of economy of fuel on board the "Great Western," might be in part attributed to the use of steam expansively. It was very desirable that the Institution should possess very full drawings and a description of the "Great Western," so as to be enabled to compare them with those of the Halifax packets, which had been promised by Mr. George Mills. He would impress upon manufacturers of marine engines the necessity of adopting a correct and uniform nomenclature of the power placed on board steam vessels. The nominal selling power did not accord with any calculation.

Mr. Field believed the table of velocities calculated by Mr. Seaward to be very nearly accurate. The speed of the "Great Western," when loaded to her proper draught, had been as high as 13 and 8 tenths miles through still water. There was an error in the alleged speed of Cunard's vessels; they reached Halifax in ten days, Boston in three more, and then had still one day's voyage to New York. The average duration of the voyages of the "Great Western," was about fourteen days and a half. If two hundred tons were deducted from the tonnage of the "Great Western" for cargo and the accommodation for the passengers, she would then be similar to the Halifax packets. The engines of the "Great Western" were nominally estimated at four hundred horse power, and the average consumption of fuel was twenty-six tons every twenty-four hours.

During the discussion, Mr. Cubitt had calculated the following table, showing the rates of velocity which would be attained by substituting engine power, with its consequent weight of one ton per horse power, for cargo, so as to preserve the draught of water the same in all cases.

Mr. Seaward remarked, that his table of power and velocities was corroborated by Mr. Cubitt's—the practical results verified both. The great difference between the "Great Western" and the Halifax packets, consisted in the better adaptation of weight and power to tonnage, and the more economical consumption of fuel of the former over the latter—the one carrying cargo and passengers, the other only the engines and fuel, yet the "Great Western" traveled farther with the same quantity of fuel.

Table showing the power required to obtain various rates of speed in a steam vessel, where the total weight of cargo and engines remains in

all cases the same, and in which with a power of 30 *horses, a speed of five miles per hour is obtained; and the total weight carried being in all cases* 1,000 *tons, and the engines weighing one ton per horse power.*

Weight of cargo.	Weight and power in tons and horse power.	Relative speed.	Speed in miles per hour.
970	30	1	5.
940	60	2	6.299
910	90	3	7.211
880	120	4	7.937
850	150	5	8.549
820	180	6	9.085
790	210	7	9.564
760	240	8	10.
730	270	9	10.4
700	300	10	10.772
670	330	11	11.119
640	360	12	11.487
610	390	13	11.756
580	420	14	12.050
550	450	15	12.331
520	480	16	12.599
490	510	17	12.856
460	540	18	13.103
430	570	19	13.34
400	600	20	13.572
370	630	21	13.794
340	660	22	14.01
310	690	23	14.219
280	720	24	14.422
250	750	25	14.62
220	780	26	14.812
190	810	27	15.
160	840	28	15.182
130	870	29	15.3615
100	900	30	15.535
70	930	31	15.706
40	960	32	15.854
10	990	33	16.037

5 times the cube root of

[*London Journal of Arts and Sciences.*

The suggestions of Mr. Gillespie deserves attention. There is no greater cause of confusion than uncertain bearings, but even if the most accurate allowances for variation could be made, they would not be equal to a permanent line as established by monuments, either for accuracy or convenience.

[From the Northern Light.]

MAGNETIC VARIATION. *By* WILLIAM M. GILLESPIE, *Civil Engineer.*

The change in the variation of the magnetic needle now in progress, causes great embarrassment to country surveyors in their attempts to follow old lines; and the neglect of the due allowance produces frequent litigation among farmers, whose old boundaries are changed by every re-survey. Every reliable observation on this subject is therefore valuable; and the extensive circulation of the Northern Light in the interior of this State, makes it an appropriate receptacle for such data. The following observations were made during a recent survey of the enlarged Erie canal below Schenectady, and show the present bearings of three straight stretches of the canal, compared with the bearings of parallel ones observed in 1829, of as many line fences, and of the Upper Mohawk aqueduct. The number and length of the lines observed, preclude the influence of local attraction; the instrument employed has been carefully tested, and the only possible (though unlikely) source of error is in particles of iron existing in the plates of the compass used in 1829.

Objects observed.	Bearing in 1829.	Bearing in 1841.	Difference.
Straight line of 27 chains, -	S. 45$\frac{1}{2}$° E.	S. 44° E.	1° 30′
Do do 20 do -	S. 44$\frac{3}{4}$ E.	S. 43$\frac{1}{4}$ E.	1 30
Do do 16 do -	S. 58 E.	S. 56$\frac{3}{4}$ E.	1 15
Line fence, - - -	N. 31$\frac{1}{2}$ E.	N. 33 E.	1 30
Do do - - - -	North.	N. 1$\frac{3}{4}$ E.	1 45
Do do - - - -	S. 4$\frac{1}{2}$ E.	S. 3 E.	1 15
Upper Mohawk aqueduct, -	N. 16 E.	N. 17$\frac{3}{8}$ E.	1 22$\frac{1}{2}$
Average, - - - - - - - -			1° 26$\frac{1}{4}$

The above observations show that in the last twelve years there has been an increase of about one and a half degrees in the westerly variation of the north end of the needle.

Suppose A B to be a line fence, the bearing of which in 1829 was N. 31$\frac{1}{2}$° E., *i. e.* which then made an angle of 31$\frac{1}{2}$° with N S, the magnetic meridian, or direction of the needle at that time. In 1841 the bearing of the same fence is found to be N. 33° E., an increase of 1° 30′. The fence has not moved, and therefore the change must be in the direction of the magnetic needle, the north end of which now points 1° 30′ west of its former direction.

The surveyor who wishes to run out an old line in this vicinity, should apply this correction, by *adding* it to the bearings which are north or east of north, and south or west of south; and by *subtracting* it from those which are east of south, or west of north.

When to this constantly increasing variation we add the diurnal and monthly changes of the needle, it will be at once seen how imperatively the security of land owners demands some simple and

unchangeable standard. Comparatively few of those by whom the boundaries of farms are established, possess either the necessary education or instruments to enable them to determine correctly the true meridian; and the delay and expense incident to the operation must always prevent its general adoption. All the desired ends may, however, be obtained in the surest and simplest manner by a method suggested and developed by Mr. Roberts, late city surveyor of Troy. Meridian monuments should be placed in every town under the sanction of a general State law. By these the instruments used in in every survey should be required to be tested, and the variation recorded in the field-notes. When a re-survey is desired, the present bearing of these monuments (which is taken as easily as any other course) is compared with the recorded one, and the compass is adjusted by its nonius for the change. Even if the line of the monuments should not be perfectly correct, the permanence of its direction would be sufficient to show the relative change from year to year, and for this purpose it would be a surer guide than even the most accurate establishment of a meridian line; since it has been suggested with some plausibility, that the meridians may vary in consequence of a change in the position of the terrestrial poles. The subject is one well deserving legislative attention; but until some uniform standard is established, every observer should contribute his mite to the common stock of recorded facts.

SCHENECTADY, *November* 27, 1841.

EXTRACT FROM "A SKETCH OF A RAILWAY JUDICIOUSLY CONSTUCTED BETWEEN DESIRABLE POINTS."

The New Jersey railway, from Jersey City to New Brunswick, 34 miles, shows the advantage of way travel and low fares on a comparatively *dense population*. From its statement of 22d February, 1841, we extract as follows:

The cost of the road (including $353,000 for right of way,) and motive power, etc., $1,951,600. It has been in partial operation for some time, and was opened to the Philadelphia travel on 1st of January, 1839. The highest grade on it is twenty-six feet per mile.

Gross receipts in 1839 were	$233,700	Expenses in 1839,	$110,800
" " 1840 "	203,100	" 1840,	116,700
	$436,800		$227,500

Average of expenses on gross receipts equal to - 52 per ct.

Through passengers in 1840, at $1, -	79,300		
Way passengers between Newark and New York, - - - -	215,700		Gross receipts
Way passengers between all other places, - - - - -	108,090—323,700		$203,100.
Merchandize, tons, - - -	5,300		

The way travel amounted to nearly two-thirds of the gross receipts. Its influence on the meat market is most salutary—it has frequently delivered in one train from New Brunswick in two hours 50 to 60 head of cattle that are scarcely sensible of a change of place, while by boats they are worried out of at least 8 per cent. of their fat, and arrive otherwise unmarketable.

The first six months of 1841, shows a rapid increase of travel on this road, attributable, no doubt, to the great despatch and accommodation which is there found by the public. The low fares are here also very operative, and during the holiday week, embracing the 4th of July, near 10,000 people passed over the road at an average charge of only 30 cents per head. Prior to this convenience, its line was comparatively a desert. It is much to be regretted that it should be intercepted near midway between two such important terminations, and should be subject to the *disadvantages of a short line*, its present equipment for 34 miles, answering nearly for the whole distance to Philadelphia of 87 miles. With the practicability of getting through this distance in 4 hours easily, full in view, it is hard that people are obliged to be quiescent under the present 7 hour system.

It may, however, in the meantime, be confidently expected that the way travel will meet all the expenses of the road; and as they have now temporarily arranged with the Camden line, for a more equal participation in the *through travel*, this source will no doubt in future give fair dividends to the stockholders.

The falling off in receipts in 1840, was owing to interruptions occasioned by the burning of the long bridge over the Hackensack; this and some other disasters by freshets to the turnpike bridges which they have to maintain, obliged them to intermit the dividend at the beginning of 1841.

Some competition is still maintained by the steamboats to Newark and New Brunswick, charging to the latter place, 40 miles, 12½ cts., while by the railroad, 34 miles, at 75 cents, it gets the majority of the travel, and the boats scarcely maintain themselves. The road would have conceded to them the freight between these points, but disagreeing, they have now put on a line leaving Brunswick early in the morning, which brings the market truck to the city two or three hours before the boat, and enables them to return in the evening at 5 o'clock, the passage money being twenty-five cents for both ways.

The competition between a railway and a steamboat line is here found under so near a parity of circumstance as to make it a fair contest, and the result is decidedly in favor of the former, to which we may well refer in support of the ground taken by the projectors of the New York and Albany railway, and which we have detailed in note No. 30, as to their ability to contend successfully against steamboats on the Hudson river, so as at least to compel them into a rate that would be mutually advantageous, and at the same time be an accommodation to the public. The business will be quite ample for both on this constantly growing thoroughfare.

STATE WORKS OF INDIANA. *Extract from Governor Bigger's Message.*

In the year 1827, the State of Indiana obtained from the General Government a grant of land to aid in the construction of the Wabash and Erie canal, with a view to connect the Wabash river with Lake Erie. A portion of this grant was surrendered to the State of Ohio on the condition that she would construct the canal from the boundary of Indiana to the lake. This canal has been completed, ready for navigation, from Lafayette on the Wabash, to the eastern line of the State. This work is not generally regarded as forming a part of the general system of internal improvements, in the prosecution of which the State subsequently engaged in the year 1836. It is now understood that Ohio will complete her portion of the line in 1842; by which an uninterrupted communication will be opened between the Wabash and Lake Erie.

In the month of January, 1836, the Legislature passed an act to provide for a general system of internal improvements, embracing a number of expensive works. The extent and present condition of these works, including the Wabash and Erie canal, with the total disbursement thereon, up to the present time, with the expenditure under every head, may be briefly summed up as follows:

1. The Wabash and Erie canal from the State line to Tippecanoe, 129 and three-quarters miles in length, completed and navigable for the whole distance, at a total expenditure, including payments for every purpose, of $2,041,012. This sum includes the cost of the steamboat lock at the Delphi dam, now nearly finished.

2. The extension of the Wabash and Erie canal from the mouth of Tippecanoe to Terre Haute, 104 and one-half miles—total probable cost, $1,500,000—amount expended, $308,855. The navigation opened so far down as Lafayette, and a portion of the work performed in the vicinity of Covington.

3. The Crosscut canal from Terre Haute to Central canal, 49 miles in length; estimated cost, $718,672; amount expended, $420,679. No part of the work is navigable.

4. The White Water canal, from Lawrenceburg to the mouth of Nettle creek, 76 and one-half miles; total estimated cost, $1,675,738; amount expended, $1,099,867. Thirty-one miles of this work navigable, extending from the Ohio river to Brookville.

5. The Central canal, from the Wabash and Erie canal to Indianapolis, including the feeder dam to Muncietown; total distance, 124 and one-quarter miles; total estimated cost, $2,299,853; amount expended, $568,046. Eight miles completed, other portions nearly done.

6. Central canal, from Indianapolis to Evansville, on the Ohio river; length 194 miles; total estimated cost, $3,532,394; amount expended, $831,302; 19 miles of which at the southern end, connecting with the Ohio river, is finished, and 16 miles, extending south from Indianapolis, nearly finished.

7. Erie and Michigan canal, 182 and three-quarters miles; estimated cost, $2,624,823; amount expended, $156,324. No part of this work is finished.

8. The Madison and Indianapolis railroad, 85 and three-quarters miles long; total estimated cost, $2,046,600; amount expended, $1,493,013. Road finished and in operation for about 28 and one-quarter miles. Grading very nearly finished on 27 and one-quarter miles in addition, extending to Edinburgh.

9. Indianapolis and Lafayette turnpike road; 73 miles in length; total estimated cost, $593,737; amount expended, $72,182. The bridging and most of the grading done on 27 miles from Crawfordsville to Lafayette.

10. New Albany and Vincennes turnpike road, 105 miles long; estimated cost, $1,127,295; amount expended, $654,411. Forty-one miles graded and McAdamized, extending from New Albany to Paoli, and 27 miles in addition partly graded.

11. Jeffersonville and Crawfordsville road, 164 and three-quarters miles long; total estimated cost without metalling, $952,000; with metalling added, the cost would be $1,651,800; amount expended, $372,733; forty-five miles partly graded and bridged, extending from Jeffersonville to Salem, and from Greencastle north.

12. Improvement of the Wabash rapids, undertaken jointly by this State and Illinois; one-half of the estimated cost of which is $102,500; amount expended by Indiana, $9,539.

There has also been paid for the general contingent expenses of the Board of Internal Improvements, for the purchase of instruments, etc., chargeable alike to all the public works, the sum of $35,564 41.

By summing up the foregoing statement, it will be seen that the whole length is 1,289 miles, 281 miles of which have been completed; aggregate estimated cost of all the works, $19,914,424; amount expended for all purposes, up to this date, $8,164,528 21.

The above estimates of the cost of the entire lines are based on the cost of the work already, from which it appears it would require to complete the whole of the above works, $11,750,000. At the present reduced prices it might take less, were it not for the loss and dilapidation on the unfinished portions of the works.

LIBRARIES—PUBLIC AND PRIVATE.

By estimates based on the most authentic data, it appears that the aggregate number of books in all public libraries in the United States, barely exceeds numerically, the number contained in one European city, say Lyons; and that the whole, if brought within the compass of one library, would not greatly exceed one of the first-rate libraries of Europe. They also show, that all the books in all the public libraries of this country, form but about one-tenth of the number contained in the public libraries of Germany, and half the number in those of Paris. These are startling general facts, which should engage the attention of Congress when it becomes necessary again to devise means for getting rid of a surplus revenue. How absurd all the wrangling, a few years ago, on that subject, when the national library at Washington continued but twenty-five thousand volumes!

The largest library in Europe is *La Bibliotheque du Roi* at Paris, which contains 630,000 printed volumes, and about 80,000 manuscripts, besides more than two millions of medals, maps, engravings, and historical documents. The library in the Vatican, at Rome, is said to contain 400,000 printed volumes, and 50,000 manuscripts. There are large libraries in Naples, Florence and Milan. The Royal Library of Madrid, contains about 200,000 printed volumes, kept in the Escurial palace. The Royal Library of Munich, in Bavaria, the largest in Germany, contains 540,000 printed volumes and 16,000 manuscripts. The Imperial Library of Vienna, and the Royal Libraries of Berlin and Dresden, contain each nearly 300,000 volumes. The Universites of Gottingen, Breslau and Munich, have also large libraries. The Imperial Library of St. Petersburg contains 430,000 printed volumes, and 15,000 manuscripts, and the Royal Library, of Copenhagen contains a like number of manuscripts, and 410,000 printed volumes. The Bodleian Library, at Oxford, the largest in Great Britain, contains 420,000 printed volumes, and 30,000 manuscripts. The British Museum, in London, contains nearly 300,000 volumes, besides 22,000 manuscripts; and there are extensive libraries at Cambridge, Edinburgh, and Dublin.

Besides those mentioned above, there are in nearly all the cities and large towns of Europe libraries that surpass in extent and value the best in the United States. The largest collections of books in this country are the following:

	Vols.
Philadelphia, (including Loganian)	52,000
Harvard University	45,000
Boston Athenæum	32,000
New York Society	36,000
New York Mercantile	12,500
New York Apprentices	12,000
New York Historical Society	11,000
Library of Congress	25,000
Charleston (S. C.)	16,000
Andover Theological Seminary	14,000
American Antiquarian Society	13,000
American Philosophical Society	5,400

All the books in all the Universities and Colleges of the United States, amounting to one hundred, inclusive of the libraries belonging to the students, amount, as nearly as can be calculated, to 400,000 volumes. All those in the Theological Seminaries, 35 in number, amount to 100,000 volumes. All the books in all the other libraries in the principal cities amount to 250,000 volumes—presenting an aggregate of seven hundred and fifty thousand volumes. The aggregate of all the volumes in all the public libraries of Europe, is fourteen millions five hundred and twenty-seven thousand.

Besides the public libraries which we have mentioned, there are others of less importance in some of the larger towns; and there are many private collections which are comparatively more valuable, as they do not generally embrace duplicates, worthless books,

etc., which swell the numbers of volumes in some of the public libraries. The libraries of E. D. Ingraham, Isaac R. Jackson, and Mr. Barton, of Philadelphia, each contained from 10,000 to 15,000 volumes, and there are several others which are extensive and curious, among which may be mentioned that of Mr. W. McCarty, which contains a very large number of valuable works relating to America. In New York, we believe, the largest private library is that of Clement C. Moore, (formerly one of the Professors of Columbia College) Samuel Ward, Professor Anthon, R. W. Griswold, Edwin Forrest, and many other gentlemen, have collections containing each from 5,000 to 12,000 volumes. In Boston, too, there are a large number of very excellent libraries belonging to individuals. Those of Professor Ticknor, Mr. Douce, Wm. H. Prescott and George Bancroft, are among the best. These gentlemen will pardon us, should they see this article, for alluding so particularly to the good example they have set to their fellows.

Good libraries, public and private, are increasing. The great Astor Library, in New York, will probably surpass every other in this country in the value of its books and the completeness of its collections in the various departments of science and polite letters. The Rev. Dr. Coggswell, to whom Mr. Astor has entrusted the business of purchasing, has already obtained many important works, and will continue, we understand, to enlarge the collection, as opportunities are presented, until the edifice for its reception is erected. This library, like those of Europe, will be *free;* open to any citizen or stranger of respectable manners and appearance. It is becoming fashionable, too, for all persons claiming to be gentlemen, to have books in their houses—good books, the possession of which shall evidence taste and judgment. Better times are dawning upon us.—*Philadelphia Gazette.*

The Baltimore Library contains about 14,000 volumes. Several of our citizens have very valuable private libraries, but of the precise number of volumes we are not informed—that of R. Gilmer, Esq., contains many rare and valuable books, with numerous autographs and isographs ; the collection of autographs, we believe, is the largest in this country, with the exception of that of Dr. Sprague, of Albany.—*Baltimore paper.*

RECESSION OF NIAGARA FALLS.

The last number of the Hingham Patriot contains the following sketch of some of Mr Lyell's views, expressed before the Lowell Institute, on the subject of the Falls of Niagara:

"The lecture which Mr. Lyell gave last Saturday, contained some statements so very curious and interesting that I cannot forbear giving you a little account of them. His subject was the *Recession of Niagara Falls.* He presented to his audience a very beautiful bird's-eye view (somewhat resembling the style of theatre scenery) of the whole country from Lake Erie, and including a portion of that lake, to Lewistown and Queenstown, about half way between the Falls and Lake Ontario. The view was designed by Bakewell, son of the great English geologist, and painted by Russel Smith, of

Philadelphia, an artist whose skill is well known to all who have visited the theatres of that city. It gave a distinct view of the whole course of the Niagara river, from the lake as far down as those two towns, including, of course, the Falls. These towns—the latter on the Canada, the former on the American side of the river—are built just under a precipitous cliff, 370 feet high, the scenery about which is so beautiful and grand that the lecturer said it would be well worth the visiting, even if there were no falls near, and no other attraction. This cliff is seven miles from the Falls, and the learned lecturer supposes that its base, and the whole surrounding country below, was once severed by a vast inland sea, of which the present lakes are but small remains; that, after the removal of this sea, Niagara river poured over this cliff; that then the Falls were perhaps 200 feet higher than they now are, for there is now a gradual decent in the river of 100 feet between the present Falls and Queenstown; that the Falls have been gradually wearing away this cliff underneath the river, until it is now seven miles above where it used to be; that the Falls are receding and diminishing in height year by year, till in the course of time, should the world last long enough, there will be no Niagara Falls at all—they having backed quite into Lake Erie! In their place there will only be irregular rapids. He said there was certain and incontrovertible geological proof that they had reached three miles; and it was presumable, from the face of the country and its geological structure, that they had the whole seven. The settlement of that region has been so recent that of course history can shed but little light on the matter; yet even during the short period that has elapsed since the whole country was a wilderness of bears and savages, there is historical proof of great change. The first account of the Falls that ever appeared in print was written by a Jesuit, who visited them in 1678—one hundred and sixty-three years ago, and there was then, according to his description, and according to the engraving that accompanies it, another fall from west to east, in front of and across those now existing, formed by the westerly side of the river running against Table Rock. A considerable portion of the edge of this rock has since fallen away, and of course the extra cataract caused by it has gone. He said that persons living in that vicinity told him that they could perceive a recession of about one yard per year, those who have lived there fifty years said the Falls had receded fifty yards in that number of years. Mr. Lyell said that he visited that region in company with a distinguished geologist who had been there five years before, and who said he could perceive there had been a considerable change during that period. And who do you think that fellow-traveller was? James Hall, once a Hingham boy, now one of the first geologist in America. The Falls are now 160 feet high; 760 years hence, Mr. Lyell said, computing according to the past, they would be but 120 feet high; and he gave the date (I have forgotten how far forward in the regions of futurity it was) when they would be only 80 feet high—just half of their present height! He referred also to artificial causes, canals, mills, and factories, which are turning off the water of the lakes, and will help to diminish the grandeur of the Falls."

RETURNS OF BRITISH RAILROADS.

There have been constructed and brought into operation in Great Britain, from the year 1830 to December, 1840, upwards of 1100 miles of railroads, in which has been invested about £60,000,000 sterling, or $288,000,000. The lines have been much extended during the year 1841. On the chain of railroads connecting London with Birmingham, Liverpool, Manchester and Preston, which, with the branch to Aylesbury, (7½ miles) amounts to an aggregate length of about 260 miles, the total receipts for the year ending June 30, 1840, were £1,467,562. The expenses during the same period including interest on borrowed money, being £920,893; or nearly 56 per cent; making an average daily income of £49 20s. 14d. or £15 9s. 3d, (about $74,) per mile. The receipts on these railroads since that period have greatly increased, while the expenses have diminished.

The London Railway Magazine, of October 30, gives the returns for one week in October, of a number of railroads in Great Britain, and one in Ireland, from which we have prepared the following tables:

Name	Total weekly receipts.	Receipts per mile week.	Length per miles.
Birmingham and Derby,	£1,283	£29½	48
Birmingham and Gloucester,	1,862	38½	48¼
Chester and Birkenhead,	446	29¾	14½
Eastern Counties,	824	47	17
Glasgow and Ayr,	1,116	28	40½
Glasgow and Paisley,	819	33¾	22
Grand Junction and branches,	9,049	76	119
Great North of England,	1,339	33½	44
Great Western,	12,992	102½	117½
Hull and Selby,	955	31	30¾
Lancaster and Preston,	514	25¼	20½
Liverpool and Manchester,	4,685	151	31
London and Birmingham,	16,148	142¾	112½
Aylesbury branch,			7½
London and Blackwell,	668	178⅛	3₂
London and Brighton,	2,218	47¼	48
London and Croyden,	491	46¾	8¾
London and Greenwich,	779	208	3¾
London and South Western,	5,607	73¼	76¾
Manchester, Bolton, etc.,	586	58¾	10
Manchester and Birmingham,	313	62½	49½
Manchester and Leeds,	4,348	87	56
Midland Counties,	2,658	46¾	57
Newcastle and Carlisle,	1,501	25	60
Northern and Eastern,	890	34½	28¾
North Midland,	4,331	59½	72
North Union,	1,118	48	22½
Preston and Wyre,	249	12¾	19½
Ulster, (Ireland.)	203	25½	8
York and North Midland,	1,655	72	23
Total receipts in one week,	£79,646		1,226

Equal to $382,300, averaging on the above 1,226 miles of railroad, $312 per mile. "About 40 per cent., or two-fifths of the receipts," says the London Railway Magazine, "may be accounted for wear and tear, and the rest is profit to pay interest of cost." The nett income of the above railroads during the week stated, after deducting 40 per cent., is about $187 per mile, or $229,380 on the 1,226 miles—equivalent to $11,927,760 per annum.

It is to be observed that several of the works in the above list are only in part opened, but the length of each railroad, as stated, is near the actual number of miles at present in operation.

The following are the returns of passengers conveyed in one week in October, on some of the above railroads:

	Per week.	Per day.
Chester and Birkenhead, - - -	5,356	765
Eastern Counties, - - -	25,192	2,170
Glasgow and Ayr, - - -	12,939	2,157
Glasgow and Paisley, - - -	11,961	1,993
Great Western, - - -	29,783	4,255
Hull and Selby, - - -	3,801	543
Lancaster and Preston, - - -	2,314	331
London and Blackwell, - - -	35,340	5,049
Do and Brighton, - - -	4,342	620
Do and Croyden, - - -	7,897	1,128
Do and Greenwich, - - -	25,617	3,660
Manchester and Birmingham, - -	10,820	1,546
Midland Counties, - - -	9,382	1,340
Northern and Eastern, - - -	9,557	1,365
North Union, - - - -	3,936	562
Preston and Wyre, - - -	1,927	275
Ulster, (Belfast) - - -	7,288	1,041
York and North Midland, - - -	7,771	1,110
Total 536 miles, - - -	205,223	29,810
Average per mile, - - -	383	55

This number of passengers would be equal to 440 per day on 8 miles of the Harlem railroad, 4,290 on the Utica and Schenectady railroad, (78 miles.) or 24,750 on the New York and Erie railroad, (450 miles.)—*N. Y. Courier and Enquirier.*

New Machine for Breaking Hemp.—We are indebted to an observing friend, for the following account of a valuable improvement in the mode of breaking hemp. Its general adoption will prove a valuable aid in getting out this valuable staple of our State. —*Kentucky paper.*

"I made a visit to the country ten days since, to witness the operation of a *Hemp Breaking Machine*, recently erected on Mr. Breckenridge's farm on Beargrass, by Mr. Denseford, his ingenious overseer. I found the machine breaking, or crushing hemp, with a rapidity that more than supplied ten men who were at their breaks, with

hemp, and enabled them to dress or clean about a double quantity. The machine is simple in its construction and operation, and is propelled by horse power. A single horse is sufficient.

"Two fluted cylinders are placed horizontally in a frame, so as when in motion, to draw the hemp between them, and so crushing the stock as easily to detach the lint from it. To build the hemp breaker and horse power, will probably not cost more than fifty or sixty dollars, and the whole is easily removed on a common wagon.

"When I saw it in operation, it was breaking water rotted hemp, which appeared to have been insufficiently rotted, but I was told by Mr. Denseford, his hands were then cleaning three times the quantity per day, that they had done without the aid of the machine.

"This machine will, I think, be a most valuable anxiliary to the hemp growers, as it will enable them so greatly to expedite the heaviest and most tedious part of their work. A boy of fifteen, will, with the hemp breaker by the machine, do the work of two men. I understand Mr. Denseford has take steps to obtained a patent."

Boston and Buffalo.—The great chain of railroad, between Boston and Buffalo, is made up of ten distinct links, all uniting with each other and presenting a continuous line. The length and cost of each work is thus stated in the New York Express. They are all completed except 39 miles, from Batavia (via Attica) to Buffalo:

	Length.	Cost.
1. Boston and Worcester, - - -	44½	$1,934,981
2. Western Worcester to West, Stockbridge, - - -	117	6,235,025
3. Albany and West Stockbridge, - -	38½	1,412,480
Total Boston to Albany, - -	200	6,582,386
4. Mohawk and Hudson, - - -	16	1,100,000
5. Utica and Schenectady, - - -	78	1,901,785
6. Syracuse and Utica, - - -	53	1,011,000
7. Auburn and Syracuse, - - -	26	(nearly 630,000
8. Auburn and Rochester, - - -	78	(nearly 1,500,000
9. Rochester and Batava - - -	32	399,876
Total completed - - -	483	16,125,147
10. Batava and Buffalo (via Attica) -	39	(estimate 500,000
Total Boston to Lake Erie, - -	522	$16,625,147

In the above cost of railroads in the State of New York, west of the Hudson river, the depots, engines, cars, etc., are included; it is probable that a further sum should be added for those items on part of the eastern lines, and the aggregate cost of the whole line from Boston to Buffalo may be put down at 16,000,000 of dollars. The distance from New York city to Buffalo by the same route is 472 miles, of which over 100 miles of railroads are yet to be made. From New York to Dunkirk, on Lake Erie, by the New York and

Erie railroad, including 22 miles of river navigation to Piermont, the distance will be about 468 miles, and the cost of the New York and Erie railroad is estimated at $9,000,000. Difference of distance to Lake Erie, in favor of New York over Boston, 54 miles, and difference of cost of railroads $7,000,000, also in favor of New York, when both chains shall have been completed.

ANTHRACITE COAL TRADE.— The immense value of the anthracite coal trade of Pennsylvania may be seen in the fact that the amount mined and sent to market this year will exceed 1,000,000 tons, worth in the market $5,000,000. In 1820 the first anthracite was sent to market, and then only 365 tons. It has been steadily increasing during the last 20 years, until it has at length reached 1,000,000 tons.

The following will show the amount shipped from the several mining districts :

Schuylkill, - - - - -	587,157 tons.
Maunch Chunk, - - - -	140,127 "
Lackawanna, - - - - -	195,480 "
Wyoming, about - - - -	47,000 "
Pinegrove, - - - - -	25,600 "
Shamokin, - - - - -	21,462 "
Lykens Valley, - - - -	1,000 "
	1,017,827 "

We have at length reached a 1,000,000 of tons. This amount would have been greatly increased had it not have been for several accidents. The great spring freshet so much injured the Lehigh improvements that no coal was brought down the canal until sometime in August. This prevented the mining on the Lehigh of at least 100,000 tons. The draining off of the dam by the Union canal company, thus shutting up the Pinegrove region in June, prevented 25,000 additional tons from being sent to market. The low water in the Susquehanna prevented 5,000 tons from being sent to market from Lykens Valley, making in all 140,000 tons. Next year 1,200,000 will be mined and sent to market.—*Harrisburg Intelligencer.*

PENNSYLVANIA LEAD.—It would appear from the following article in the Sunbury American that there is a fair promise that *lead* will be added to the list of mineral resources in which the State of Pennsylvania abounds so abundantly :

The lead mine discovered near Sunbury, is not, as some suppose, one of the humbugs of the day. Several miners have been engaged for the last six months, in driving gangways and making other excavations. During that time they have taken out about one hundred tons of good ore. We were informed by one of the miners that they have now extended the gangway almost two hundred feet into the hill, and that the vein of ore presents a breast of about five and a half feet. There are, in all, eight veins, imbedded in compact limestone. These veins are plainly visible, cropping out, as the miners term it, on the top of the hill, ranging from five to twenty

feet apart. The workmen say that two hands can take out about fifty tons of ore per month. This ore, we understand, has been analyzed in New York and Philadelphia, and found to yield from 60 to 80 per cent., depending upon the quality of the specimens tested. We have seen bullets, cast from it by smelting some of the ore in an iron ladle, over a common smith's fire. Those interested in the work, intend to put up a smelting furnace early in the spring, when the whole matter will be fully and fairly tested.

A Great Work of Art—The Box Tunnel.—The Great Western railway, England, is a magnificent work, and is marked by many extraordinary indications of labor and enterprise. It is the longest independent line of railway completed in England. The "box tunnel," which forms one of its principal features, pierces through Box Hill, between Chippenham and Bath—part of which is 400 feet above the level of the railway. The tunnel is 9,680 feet long, 39 high, and 35 wide, to the outside of the brick work. The excavation amounted to 414,000 cubic yards, and the brick work and masonry to more than 54,000 cubic yards. About 30,000,000 of bricks were used. A ton of gunpowder and a ton of candles were consumed every week for two and a half years, and 1,100 men and 250 horses were kept constantly employed. For a considerable distance the tunnel passes through freestone rock, from the fissures of which there was at times an immense influx of water. This formed such an impediment, that the work was on one occasion discontinued for a long time. But the water was finally pumped out through the agency of a steam engine of 50 horse power, which threw it out at the rate of 32,000 hogsheads a day. The contractors, Messrs. Bremer and Lewis, deserve immense praise for their indefatigable exertions.

Private Economy of the Chinese.—The interiors of some of the houses were found beautifully furnished and carved; one that is now inhabited by governor, and believed to have been the property of a literary character, was, when first opened, the wonder and admiration of all. The different apartments, opened round the centre court, which is neatly tiled; the doors, window frames and pillars that support the pent roof, are carved in the most chaste and delicate style, and the interior of the ceiling and wainscot are lined with fret work, which it must have required the greatest nicety and care to have executed. The furniture was in the same keeping, denoting a degree of taste the Chinese have not in general credit for with us. The bed places in the sleeping apartments of the ladies were large dormitories, for they can hardly be called beds; at one corner of the room is a separate chamber, about eight feet square, and the same in height; the exterior of this is usually painted red, carved and gilt, the entrance is through a circular aperture three feet in diameter, with sliding pannels, in the interior is a couch of large proportions, covered with a soft mat and thick curtains of mandarin silk; the inside of the bed is polished and painted, and a little chair and table are the remaining furniture of this extraordinary dormitory.—*Lord Jocelyn's Six Months with the Chinese Expedition.*